CLAIMS:

1. A method for driving a liquid crystal display device, for an alignment transition from splay alignment to bend alignment in a liquid crystal display device which comprises a pair of substrates and a liquid crystal layer disposed between the substrates; wherein, when no voltage is applied, the liquid crystal layer, which has been subjected to a parallel alignment process, is in splay alignment, in which pretilt angles of the liquid crystal at an upper and at a lower boundary of the liquid crystal layer have opposite signs; wherein, before liquid crystal display driving, an initialization process is performed, in which the alignment of the liquid crystal layer is transitioned from splay alignment to bend alignment by application of a voltage to the substrates; and wherein the liquid crystal display driving is performed in the bend alignment attained by this initialization;

comprising applying to the substrates an ac voltage superimposed with a bias voltage to cause transition of the liquid crystal layer into bend alignment.

2. A method for driving a liquid crystal display device, for an alignment transition from splay alignment to bend alignment in a liquid crystal display device which comprises a pair of substrates and a liquid crystal layer disposed between the substrates; wherein, when no voltage is applied, the liquid crystal layer, which has been subjected to a parallel alignment process, is in splay alignment, in which pretilt angles of the liquid crystal at an upper and at a lower boundary of the liquid crystal layer have opposite signs;

wherein, before liquid crystal display driving, an initialization process is performed, in which the alignment of the liquid crystal layer is transitioned from splay alignment to bend alignment by application of a voltage to the substrates; and wherein the liquid crystal display driving is performed in the bend alignment attained by this initialization;

comprising a step of applying to the substrates an ac voltage superimposed with a bias voltage, and a step of putting the substrates into an electrically released state, repeated in alternation so as to cause transition of the liquid crystal layer into bend alignment.

3. A method for driving a liquid crystal display device, for an alignment transition from splay alignment to bend alignment in a liquid crystal display device which comprises a pair of substrates and a liquid crystal layer disposed between the substrates; wherein, when no voltage is applied, the liquid crystal layer, which has been subjected to a parallel alignment process, is in splay alignment, in which pretilt angles of the liquid crystal at an upper and at a lower boundary of the liquid crystal layer have opposite signs; wherein, before liquid crystal display driving, an initialization process is performed, in which the alignment of the liquid crystal layer is transitioned from splay alignment to bend alignment by application of a voltage to the substrates; and wherein the liquid crystal display driving is performed in the bend alignment attained by this initialization;

comprising a step of applying to the substrates an ac voltage superimposed with a bias voltage, and a step of applying zero voltage or a low voltage to the substrates, repeated in alternation so as to cause

transition of the liquid crystal layer into bend alignment.

4. The method for driving a liquid crystal display device according to Claim 3, wherein the ac voltage superimposed with the bias voltage is replaced with a dc voltage.

5. The method for driving a liquid crystal display device according to Claim 2, wherein the frequency of the voltage repeated in alternation is in the range of 0.1Hz to 100Hz, and the duty ratio of the voltage repeated in alternation is in the range of at least 1 : 1 to 1000 : 1.

6. The method for driving a liquid crystal display device according to Claim 3, wherein the frequency of the voltage repeated in alternation is in the range of 0.1Hz to 100Hz, and the duty ratio of the voltage repeated in alternation is in the range of at least 1 : 1 to 1000 : 1.

7. The method for driving a liquid crystal display device according to Claim 1, wherein the liquid crystal display device is an active matrix liquid crystal display device, and wherein the ac voltage is applied between a pixel electrode of the active matrix liquid crystal display device that is coupled to a switching element formed on one of the substrates and a common electrode formed on the other substrate.

8. The method for driving a liquid crystal display device according to Claim 3, wherein the liquid crystal display device is an active matrix liquid

crystal display device, and wherein the ac voltage is applied between a pixel electrode of the active matrix liquid crystal display device that is coupled to a switching element formed on one of the substrates and a common electrode formed on the other substrate.

9. The method for driving a liquid crystal display device according to Claim 8, wherein the ac voltage is applied to the common electrode.

10. The method for driving a liquid crystal display device according to Claim 4, wherein the liquid crystal display device is an active matrix liquid crystal display device, and wherein the dc voltage is applied between a pixel electrode of the active matrix liquid crystal display device that is coupled to a switching element formed on one of the substrates and a common electrode formed on the other substrate.

11. The method for driving a liquid crystal display device according to Claim 10, wherein the dc voltage is applied to the common electrode.

12. The method for driving a liquid crystal display device according to Claim 1, wherein the value of the ac voltage is set to a critical voltage that is a minimum voltage necessary for transitioning the liquid crystal layer from splay alignment to bend alignment.

13. The method for driving a liquid crystal display device according to Claim 4, wherein the value of the ac voltage is set to a critical voltage that is

a minimum voltage necessary for transitioning the liquid crystal layer from splay alignment to bend alignment.

14. The method for driving a liquid crystal display device according to Claim 3, wherein the voltage is an alternated voltage averaging over time.

15. A liquid crystal display device comprising a pair of substrates and a liquid crystal layer disposed between the substrates; wherein, when no voltage is applied, the liquid crystal layer, which has been subjected to a parallel alignment process, is in splay alignment, in which pretilt angles of the liquid crystal at an upper and at a lower boundary of the liquid crystal layer have opposite signs; wherein, before liquid crystal display driving, an initialization process is performed, in which the alignment of the liquid crystal layer is transitioned from splay alignment to bend alignment by application of a voltage to the substrates; wherein the liquid crystal display driving is performed in the bend alignment attained by the initialization;

comprising a voltage application means for applying to the substrates an ac voltage or a dc voltage superimposed with a bias voltage, so as to transition the liquid crystal layer from splay alignment to bend alignment.

16. The liquid crystal display device according to Claim 15, wherein the value of the ac voltage or dc voltage is set to a critical voltage that is a minimum voltage necessary for transitioning the liquid crystal layer from splay alignment to bend alignment.

17. An active matrix liquid crystal display device comprising an array substrate provided with a pixel electrode; an opposing substrate provided with a common electrode; and a liquid crystal layer arranged between the array substrate and the opposing substrate; wherein pretilt angles of the liquid crystal at an upper and at a lower boundary of liquid crystal layer have opposite signs, and in a liquid crystal cell in splay alignment, which has been subjected to a parallel alignment process, the liquid crystal is in splay alignment when no voltage is applied; wherein, before liquid crystal display driving, an initialization process is performed, in which the alignment of the liquid crystal layer is transitioned from splay alignment to bend alignment by application of a voltage; wherein the liquid crystal display driving is performed in the bend alignment attained by the initialization;

comprising a liquid crystal cell including at least a first liquid crystal cell region, wherein a liquid crystal pretilt angle at an alignment film formed on an inner side of the array substrate is a first pretilt angle, and wherein a liquid crystal pretilt angle at an alignment film formed on an inner side of the opposing substrate is a second pretilt angle larger than the first pretilt angle; and a second liquid crystal cell region arranged next to the first liquid crystal cell region within the same pixel; wherein a liquid crystal pretilt angle at an alignment film formed on an inner side of the array substrate is a third pretilt angle; and wherein a liquid crystal pretilt angle at an alignment film formed on an inner side of the opposing substrate is a fourth pretilt angle larger than the third pretilt angle, the alignment films having been subjected to an alignment process directed from the first liquid crystal cell region to the second liquid crystal cell region;

a first voltage application means for applying a first voltage between the pixel electrode and the common electrode so as to form a disclination line at a border between the first liquid crystal cell region and the second liquid crystal cell region; and

a second voltage application means for creating transition seeds at the disclination line by applying a second voltage larger than the first voltage between the pixel electrode and the common electrode, and causing transition from splay alignment to bend alignment.

18. The liquid crystal display device according to Claim 17, wherein the first and the fourth pretilt angles are at most 3°, and the second and third pretilt angles are at least 4°.

19. The liquid crystal display device according to Claim 17, wherein the direction in which the alignment films are subjected to the alignment process is perpendicular to signal electrode lines or gate electrode lines arranged along the pixel electrode.

20. The liquid crystal display device according to Claim 17, wherein the direction in which the alignment films are subjected to the alignment process is slightly askew to a direction perpendicular to signal electrode lines or gate electrode lines arranged along the pixel electrode.

21. The liquid crystal display device according to Claim 17, wherein the second voltage is pulse–shaped with a frequency in the range of 0.1Hz to

100Hz, and a duty ratio in the range of at least 1 : 1 to 1000 : 1.

22. The liquid crystal display device according to Claim 17, wherein the gate electrode lines are in a high state for at least most of said transition period.

23. The liquid crystal display device according to Claim 17, comprising a liquid crystal cell that has been alignment partitioned by irradiating UV light on a portion of at least one of the alignment films formed on the inner sides of the pixel electrode and the common electrode so that the pretilt angle of the liquid crystal at that alignment film is changed.

24. The liquid crystal display device according to Claim 17, comprising a liquid crystal cell that has been alignment partitioned by irradiating a portion of the pixel electrode and a portion of the common electrode with UV light under an ozone atmosphere to flatten at least one of the portions of the pixel electrode and the common electrode, and applying and baking an alignment film on the pixel electrode and the common electrode, so as to change the pretilt angle of the liquid crystal at the alignment film.

25. A method for manufacturing an active matrix liquid crystal display device, the active matrix liquid crystal display device comprising an array substrate provided with a pixel electrode; an opposing substrate provided with a common electrode; and a liquid crystal layer arranged between the array substrate and the opposing substrate; wherein pretilt angles of the

liquid crystal at an upper and at a lower boundary of the liquid crystal layer have opposite signs, and in a liquid crystal cell in splay alignment, which has been subjected to a parallel alignment process, the liquid crystal is in splay alignment when no voltage is applied; wherein, before liquid crystal display driving, an initialization process is performed, in which the alignment of the liquid crystal layer is transitioned from splay alignment to bend alignment by application of a voltage; wherein the liquid crystal display driving is performed in the bend alignment attained by the initialization;

comprising:

a preparation step of preparing a liquid crystal cell in splay alignment, which has been subjected to a parallel alignment process, wherein the pretilt angles of the liquid crystal at the upper and lower boundaries of the liquid crystal layer arranged between the array substrate provided with the pixel electrode and the opposing substrate provided with the common electrode have opposite signs;

a disclination line forming step of applying a first voltage for forming a disclination line between the pixel electrode and the common electrode, and forming a disclination line at a boundary between a first liquid crystal cell region and a second liquid crystal cell region; and

an alignment transition step for transition from splay alignment to bend alignment of applying a second voltage larger than the first voltage between the pixel electrode and the common electrode, and creating transition seeds at the disclination line at the boundary between the first liquid crystal cell region and the second liquid crystal cell region.

26. The method for manufacturing a liquid crystal display device according to Claim 25, wherein the preparation step includes:

an alignment process step of arranging the liquid crystal molecules in one pixel region in b–splay alignment by subjecting them to an alignment process such that a pretilt angle of the liquid crystal on the pixel electrode side becomes smaller than a pretilt angle of the liquid crystal on the common electrode side, and arranging the liquid crystal molecules in another pixel region in t–splay alignment by subjecting them to an alignment process such that a pretilt angle of the liquid crystal on the pixel electrode side becomes larger than a pretilt angle of the liquid crystal on the common electrode side.

27. The method for manufacturing a liquid crystal display device according to Claim 26, wherein the alignment process step includes alignment partitioning by irradiating UV light on a portion of the alignment film formed on an inner surface side of at least one electrode of the pixel electrode and the common electrode to change the pretilt angle of the liquid crystal.

28. The method for manufacturing a liquid crystal display device according to Claim 26, wherein the alignment process step includes alignment partitioning by irradiating a region of at least one electrode of the pixel electrode and the common electrode with UV light under an ozone atmosphere, flattening a portion of the pixel electrode and the common electrode, and then applying and baking an alignment film on the pixel electrode and the common electrode to change the pretilt angle of the liquid

crystal at the alignment film.

29. An active matrix liquid crystal display device comprising an array substrate provided with a pixel electrode; an opposing substrate provided with a common electrode; a liquid crystal layer arranged between the array substrate and the opposing substrate; wherein pretilt angles of the liquid crystal at an upper and at a lower boundary of liquid crystal layer have opposite signs, and in a liquid crystal cell in splay alignment, which has been subjected to a parallel alignment process, the liquid crystal is in splay alignment when no voltage is applied; wherein, before liquid crystal display driving, an initialization process is performed, in which the alignment of the liquid crystal layer is transitioned from splay alignment to bend alignment by application of a voltage; wherein the liquid crystal display driving is performed in the bend alignment attained by the initialization; and

wherein each pixel has at least one transition–inducing transversal field application portion due to which a transversal electric field is generated, and applying a continuous or intermittent voltage to the pixel electrode and the common electrode, transition seeds are created in each pixel, and the pixels transition from splay arrangement to bend arrangement.

30. The liquid crystal display device according to Claim 29, wherein the transversal electric field generated by the transversal electric field application portions is substantially perpendicular to the direction of the alignment process.

31. The liquid crystal display device according to Claim 29, wherein the transversal electric field application portions

are electrode deformation portions, in which sides of the pixel electrodes are deformed to protrusions and recesses in a plane parallel to the substrate plane.

32. The liquid crystal display device according to Claim 29, wherein the transversal electric field application portions

are electrode line deformation portions, in which signal electrode lines or gate electrode lines are deformed to protrusions and recesses in a plane parallel to the substrate plane.

33. The liquid crystal display device according to Claim 29, wherein the transversal electric field application portions

are deformations in the electrodes and the electrode lines, in which sides of the pixel electrodes are deformed to protrusions and recesses in a plane parallel to the substrate plane, and in correspondence to these protrusions and recesses, signal electrode lines or gate electrode lines are deformed to protrusions and recesses in a plane parallel to the substrate plane.

34. The liquid crystal display device according to Claim 29, wherein the transversal electric field application portions

are transversal electric field application line deformation portions in transversal electric field application lines that are deformed to protrusions

and recesses in a plane parallel to the substrate plane, wherein the transversal electric field application lines are arranged in a layer above or below at least one of signal electrode lines or gate electrode lines and in the same direction as these, separated from them by an insulting film, and wherein the transversal electric field application lines are connected to a driving circuit, to which also the signal electrode lines or gate electrode lines are connected.

35. The liquid crystal display device according to Claim 34, wherein the transversal electric field application lines are disconnected from the driving circuit during regular liquid display after alignment transition.

36. An active matrix liquid crystal display device comprising an array substrate; an opposing substrate; and a liquid crystal layer arranged between the array substrate and the opposing substrate; wherein pretilt angles of the liquid crystal at an upper and at a lower boundary of liquid crystal layer have opposite signs, and in a liquid crystal cell in splay alignment, which has been subjected to a parallel alignment process, the liquid crystal is in splay alignment when no voltage is applied; wherein, before liquid crystal display driving, an initialization process for a transition from splay alignment to bend alignment is performed by application of a voltage; and wherein the liquid crystal display driving is performed in the bend alignment attained by the initialization;

comprising at least one of a pixel electrode and a common electrode, wherein a defect portion for application of a transition–inducing transversal

electric field is formed at least at one location in each pixel.

37. An active matrix liquid crystal display device comprising an array substrate; an opposing substrate; and a liquid crystal layer arranged between the array substrate and the opposing substrate; wherein pretilt angles of the liquid crystal at an upper and at a lower boundary of liquid crystal layer have opposite signs, and in a liquid crystal cell in splay alignment, which has been subjected to a parallel alignment process, the liquid crystal is in splay alignment when no voltage is applied; wherein, before liquid crystal display driving, an initialization process for a transition from splay alignment to bend alignment is performed by application of a voltage; wherein the liquid crystal display driving is performed in the bend alignment attained by the initialization;

comprising in each pixel a transition–inducing transversal electric field application portion; and

each pixel comprising a first alignment region, wherein a pretilt angle of liquid crystal molecules in one region at a pixel electrode is a first pretilt angle, and a pretilt angle of liquid crystal molecules in the one region at a common electrode opposing the pixel electrode is a second pretilt angle larger than the first pretilt angle; and

a second alignment region, wherein a pretilt angle of liquid crystal molecules in another region of the pixel electrode is a third pretilt angle, and a pretilt angle of liquid crystal molecules in the other region of a common electrode opposing the pixel electrode is a fourth pretilt angle smaller than the third pretilt angle.

38. The liquid crystal display device according to Claim 29, further comprising a pulse voltage application portion for applying to the common electrode and the pixel electrode a pulse–shaped voltage with a frequency the range of 0.1Hz to 100Hz, and a duty ratio in the range of at least 1 : 1 to 1000 : 1.

39. A liquid crystal display device comprising a pair of substrates; a liquid crystal layer disposed between the substrates; and a phase compensator arranged on an outer side of the substrates; wherein, when no voltage is applied, the liquid crystal layer, which has been subjected to a parallel alignment process, is in splay alignment, in which pretilt angles of the liquid crystal at an upper and at a lower boundary of the liquid crystal layer have opposite signs; wherein, before liquid crystal display driving, an initialization process is performed, in which the alignment of the liquid crystal layer is transitioned from splay alignment to bend alignment by application of a voltage; wherein the liquid crystal display driving is performed in the bend alignment attained by this initialization;

comprising at least one region in the display pixels where the liquid crystal layer thickness is smaller than around it, and the strength of an electric field applied to the liquid crystal layer in this region is larger than the strength of an electric field applied to the liquid crystal layer around it.

40. A liquid crystal display device comprising a pair of substrates; a liquid crystal layer disposed between the substrates; and a phase

compensator arranged on an outer side of the substrates; wherein, when no voltage is applied, the liquid crystal layer, which has been subjected to a parallel alignment process, is in splay alignment, in which pretilt angles of the liquid crystal at an upper and at a lower boundary of the liquid crystal layer have opposite signs; wherein, before liquid crystal display driving, an initialization process is performed, in which the alignment of the liquid crystal layer is transitioned from splay alignment to bend alignment by application of a voltage; and wherein the liquid crystal display driving is performed in the bend alignment attained by this initialization

comprising at least one region outside the display pixels where the liquid crystal layer thickness is small, and the strength of an electric field applied to the liquid crystal layer in this region is larger than strength of an electric field applied to the liquid crystal layer in the pixels.

41. A liquid crystal display device comprising a pair of substrates; a liquid crystal layer disposed between the substrates; and a phase compensator arranged on an outer side of the substrates; wherein, when no voltage is applied, the liquid crystal layer, which has been subjected to a parallel alignment process, is in splay alignment, in which pretilt angles of the liquid crystal at an upper and at a lower boundary of the liquid crystal layer have opposite signs; wherein, before liquid crystal display driving, an initialization process is performed, in which the alignment of the liquid crystal layer is transitioned from splay alignment to bend alignment by application of a voltage; wherein the liquid crystal display driving is performed in the bend alignment attained by this initialization; and

comprising at least one location in the display pixels where the electric field concentrates.

42. The liquid crystal display device according to Claim 41, wherein the location in the display pixels where the electric field concentrates is at a portion of either the display electrode or the common electrode that partially protrudes in thickness direction of the liquid crystal layer, or both.

43. A liquid crystal display device comprising a pair of substrates; a liquid crystal layer disposed between the substrates; and a phase compensator arranged on an outer side of the substrates; wherein, when no voltage is applied, the liquid crystal layer, which has been subjected to a parallel alignment process, is in splay alignment, in which pretilt angles of the liquid crystal at an upper and at a lower boundary of the liquid crystal layer have opposite signs; wherein, before liquid crystal display driving, an initialization process is performed, in which the alignment of the liquid crystal layer is transitioned from splay alignment to bend alignment by application of a voltage; and wherein the liquid crystal display driving is performed in the bend alignment attained by this initialization;

comprising at least one location outside the display pixels where the electric field concentrates.

44. The liquid crystal display device according to Claim 43, wherein the location where the electric field concentrates is a portion of an electrode that partially protrudes in thickness direction of the liquid crystal layer.

45. A liquid crystal display device comprising a pair of substrates; a liquid crystal layer disposed between the substrates; and a phase compensator arranged on an outer side of the substrates; wherein, when no voltage is applied, the liquid crystal layer, which has been subjected to a parallel alignment process, is in splay alignment, in which pretilt angles of the liquid crystal at an upper and at a lower boundary of the liquid crystal layer have opposite signs; wherein, before liquid crystal display driving, an initialization process is performed, in which the alignment of the liquid crystal layer is transitioned from splay alignment to bend alignment by application of a voltage; wherein the liquid crystal display driving is performed in the bend alignment attained by this initialization; and

a portion of either the display electrode or the common electrode or both is provided with an aperture portion.

46. The liquid crystal display device according to Claim 45, which is an active matrix liquid crystal display device provided with switching elements, and wherein the aperture portion is a conducting via hole electrically connecting pixel electrodes formed on a flattening film and the switching elements.

47. The liquid crystal display device according to Claim 39, wherein the phase compensator includes at least one phase compensator made of an optical medium with negative reflective index anisotropy whose main axes are in hybrid arrangement.

48. The liquid crystal display device according to Claim 47, wherein the phase compensator includes at least one positive phase compensator.

49. A method for driving a liquid crystal display device comprising applying an electric field to a liquid crystal disposed between a first substrate and a second substrate arranged in opposition, and transitioning the alignment of the liquid crystal into bend alignment;

wherein the splay elastic constant k_{11} of the liquid crystal is in the range of 10×10^{-7}dyn $\geqq k_{11} \geqq 6 \times 10^{-7}$dyn; and

satisfying the relation 1.57rad > $|\theta_1 - \theta_2| \geqq$ 0.0002rad, wherein θ_1 is the absolute value of a pretilt angle of the liquid crystal with respect to the first substrate and θ_2 is the absolute value of a pretilt angle of the liquid crystal with respect to the second substrate.

50. A method for driving a liquid crystal display device comprising applying an electric field to a liquid crystal disposed between a first substrate and a second substrate arranged in opposition, and transitioning the alignment of the liquid crystal into bend alignment;

wherein the splay elastic constant k_{11} of the liquid crystal is in the range of 10×10^{-7}dyn $\geqq k_{11} \geqq 6 \times 10^{-7}$dyn; and

wherein the electric field is a main electric field E_0 applied uniformly over space, to which a secondary electric field E_1 applied non–uniformly over space is superimposed, satisfying the relation $1.0 > E_1 - E_0 > 1/100$.

51. A method for driving a liquid crystal display device comprising applying an electric field to a liquid crystal disposed between a first substrate and a second substrate arranged in opposition, and transitioning the alignment of the liquid crystal into bend alignment;

satisfying the relation $1.57\text{rad} > |\theta_1 - \theta_2| \geqq 0.0002\text{rad}$, wherein θ_1 is the absolute value of a pretilt angle of the liquid crystal with respect to the first substrate and θ_2 is the absolute value of a pretilt angle of the liquid crystal with respect to the second substrate; and

wherein the electric field is a main electric field E_0 applied uniformly over space, to which a secondary electric field E_1 applied non–uniformly over space is superimposed, satisfying the relation $1.0 > E_1 - E_0 > 1/100$.

52. A method for driving a liquid crystal display device comprising applying an electric field to a liquid crystal disposed between a first substrate and a second substrate arranged in opposition, and transitioning the alignment of the liquid crystal into bend alignment;

wherein the splay elastic constant k_{11} of the liquid crystal is in the range of $10\times10^{-7}\text{dyn} \geqq k_{11} \geqq 6\times10^{-7}\text{dyn}$; and

satisfying the relation $1.57\text{rad} > |\theta_1 - \theta_2| \geqq 0.0002\text{rad}$, wherein θ_1 is the absolute value of a pretilt angle of the liquid crystal with respect to the first substrate and θ_2 is the absolute value of a pretilt angle of the liquid crystal with respect to the second substrate; and

wherein the electric field is a main electric field E_0 applied uniformly over space, to which a secondary electric field E_1 applied non–uniformly over space is superimposed, satisfying the relation $1.0 > E_1 - E_0 > 1/100$.

53. The method for driving a liquid crystal display device according to Claim 50, wherein the secondary electric field is applied between a source electrode or a gate electrode of a thin film transistor formed on a surface of the first substrate, and a transparent electrode formed on a surface of the second substrate.

54. The method for driving a liquid crystal display device according to Claim 50, wherein the secondary field is an ac electric field whose oscillation is dampened over time.